INFORMATION PAPER

CEERD-CF-F
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SUBJECT: Reduction of Demolition Waste through Reuse and Recycling

1. **Purpose**. Provide information on diverting demolition debris from landfilling through reuse and recycling.

2. **Facts.**

a. The Army is removing thousands of buildings from its real property inventories. At present, 39 Million square feet of World War II-era buildings remain. Seventy-thousand Army Family Housing Units are being demolished under the Residential Communities Initiative. Hundreds of Korean War-era barracks, and associated buildings are being replaced with contemporary barracks complexes. In total, 26 Million tons of demolition debris will be generated within the next 15 years. Some Army installations report that construction and demolition (C&D) debris constitutes 80% of their solid waste stream.

WWII infrastructure at Fort Sheridan

b. On-post landfills are typically made available to contractors for "free" disposal. However, installations report their costs in expanding, operating, maintaining, monitoring, and eventually closing the landfill to be roughly $50 per ton over it's life. The direct cost of hauling and tipping debris in an off-post landfill can be much higher. This cost will increase as C&D landfills across the U.S. continue to close. As a reference, a typical WWII-era barracks building becomes over 110 tons of debris (about 150 cubic yards) when demolished. The economic and environmental burdens associated with landfilling debris are significant. Without reducing C&D waste, installations will not be able to meet the DoD Measure of Merit to divert 40% of solid waste.

c. Traditional demolition and landfilling debris are the common practices at Army installations. However, salvaging building materials for reuse and recycling is emerging as an accepted practice within the commercial market. Case studies published by the Triangle J Council of Governments in North Carolina indicate up to 80% of demolition debris was recycled at no additional cost, or even 50% less cost than traditional demolition & landfilling. Case studies compiled by the US Air Force Center for Environmental Excellence indicate debris diversion of up to 98%, and demolition cost savings from $0.12 to $2.28 per square foot of building. Deconstruction performed by the University of Florida Center for Construction and Environment resulted in the *net cost* of deconstruction to be roughly 37% lower than traditional demolition, when both the cost of deconstruction and the value of salvaged materials are considered. Further case study data and commercial experience indicates deconstruction and salvage can be cost-competitive with traditional demolition and landfilling. The USEPA estimates that only 20% of building related C&D debris is currently being recycled. The potential to further reduce waste is considerable.

Fort Campbell manual deconstruction

d. While not common practice, deconstruction is already being performed on some Army installations. Since 1992, 140 WWII-era buildings have been deconstructed at Fort McCoy, WI, at a savings of roughly $3.5 Million. Fort Knox has removed 285 buildings over the last three years, which has generated over $250,000 in income (through their recycle program), and saved roughly $640,000 in demolition costs. Two production buildings at Twin Cities Army Ammunition Plant totaling 925,000 square feet were deconstructed in 1995. Roughly 2.3 Million board-feet of timbers were salvaged, at a total demolition cost savings of over $400,000. Several installations are currently working to recycle concrete from demolitions.

e. ERDC-CERL[1] has worked with many installations, regulators, and researchers to develop deconstruction and demolition waste reduction practices for the Army. In partnership with the Fort Campbell Public Works Business Center, ERDC-CERL, Austin TX Habitat for Humanity[2] (AHfH), and USEPA Office of Solid Waste, five WWII-era buildings (22,000 square feet) were deconstructed at a total cost of $5.60 per square foot, including asbestos abatement and sitework. AHfH diverted 85% of the debris from the government-owned landfill. Including the landfill life cycle savings to Fort Campbell, the net cost of deconstruction was $3.12 per square foot. In addition, AHfH accrued over $41,000 worth of materials to sell at their ReStore. ERDC-CERL and the US Department of Agriculture Forest Products Laboratory also evaluated techniques to increase the potential value of siding taken from WWII-era buildings at Fort Ord, CA. This was top grade material which, when remilled into architectural millwork, could command up to $11 per square foot on the commercial market. A typical two-story barracks building would contain over $5,000 worth of millwork product. Other ERDC-CERL research includes removal of lead-based paint (LBP) from salvaged materials, applications of mechanized equipment to deconstruction, recycling concrete from buildings, identifying environmental performance of recycled concrete materials containing LBP, and modeling the cost, material values, and schedule impacts of salvaging building materials for reuse and recycling.

Wood flooring remilled from Fort Campbell siding

f. Guidance has been published to support the Army in demolition debris diversion, including memoranda issued by the Principal Deputy Secretary of the Army (Installations and Environment), 18-Jan-2001; and Assistant Chief of Staff for Installations and Management (ACSIM), 31-Aug-2001. Unified Federal Guide Specifications on C&D waste management; and Public Works Technical Bulletins (PWTBs) on deconstruction and building materials recycling authored by ERDC-CERL, issued by HQUSACE (CEMP-RI), are available on US Army Engineering and Support Center TECHINFO web site.[3] Additional guidance on deconstruction and salvaging building materials is available from non-Army sources including Air Force Center for Environmental Excellence, Used Building Materials Association, Construction Materials Recycling Association, The Deconstruction Institute, University of Florida Center for Construction and Environment, and Kentucky Pollution Prevention Center.

Fort McClellan mechanized deconstruction

3. Points of Contact

Mr. Stephen Cosper
CEERD-CN-E
217-398-5569
s-cosper@cecer.army.mil

Mr. William Eng
DAIM-FDF-UE
703-602-5827
william.eng@hqda.army.mil

Mr. Malcolm McLeod
CEMP-RI
202-761-0206
malcolm.e.mcleod@usace.army.mil

[1] http://www.cecer.army.mil
[2] http://www.re-store.com/deconstruction.htm
[3] http://www.hnd.usace.army.mil/techinfo/index.asp